NOTES FROM THE "CHALLENGER"

IV.

ON Saturday, the 15th of March, before going into the harbour of St. Thomas, a sounding was taken in 450 fathoms off the island of Sombrero. The bottom brought up by the sounding machine was globigerina mud largely mixed with broken shells, chiefly those of pteropods. The dredge was put over early, and veered to 1000 fathoms. At noon it was hauled up half filled with calcareous ooze. It was again sent down, and brought up early in the afternoon with a like freight. These dredgings, which we did not regard as entering into the regular work of the sections, but which were only undertaken to give us a general idea of the deep-water fauna of the West Indian province, may be taken in connection with one or two hauls taken with the same object and under the same circumstances, in waters of nearly equal depth on the 25th of March, after leaving St Thomas. The careful examination of this zone, between 300 and 1,200 fathoms among the West Indian Islands, will undoubtedly add enormously to zoological knowledge. The objects of the present expedition do not, of course, include a detailed investigation of this kind, which must be done quietly in a small steamer, by some one on the spot, and will require the patient work of several years. Even the few hauls of the dredge which we had it in our power to make, brought to light a number of new and highly interesting forms, representing nearly all the invertebrate groups. A thorough investigation of the belt must yield a wonderful harvest.

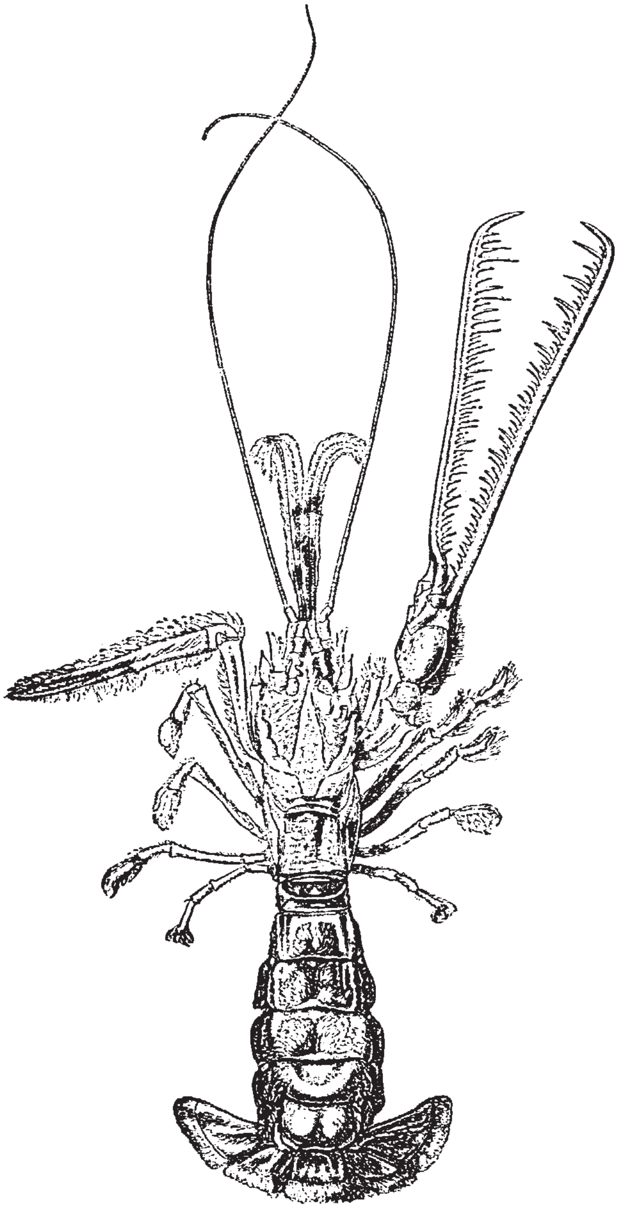

Fig. 1.—Astacus Zaleucus, v. W.-S.

In those dredgings on the 15th we got several sponges belonging to the Hexactinellidæ, very closely allied to those which we had previously met with in moderately deep water off the coast of Portugal, showing that the distribution of this remarkable order in deep water is very wide. Several stony corals occurred, but of all these, with the exception of a species of *Stylaster*, which was very abundant at this station, we got better examples on a subsequent occasion. The *Stylaster* agrees very closely with the description and figure given by Pourtalés of *S. complanatus*. The only marked difference is that the primary and secondary septa do not unite to the same extent as shown in the figure.

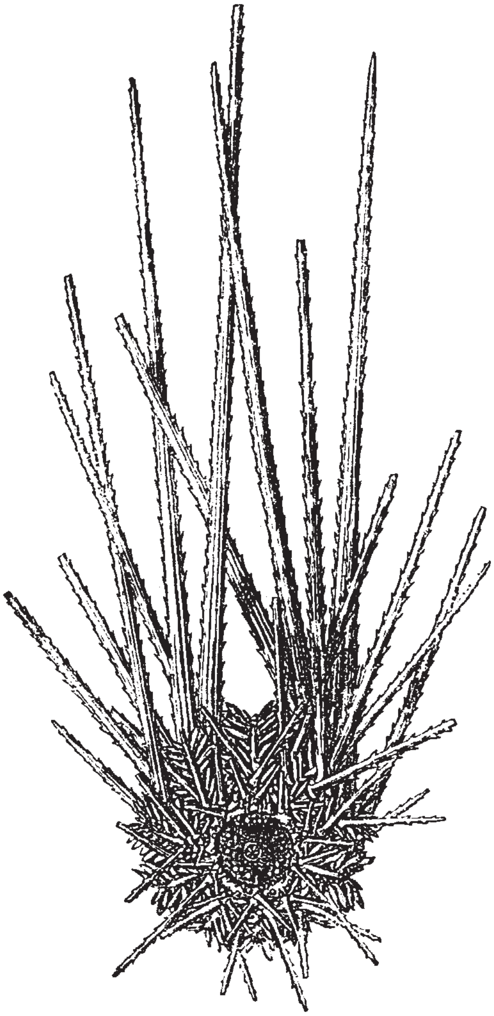

Fig. 2.—Salenica Varispina, A Ag.

In this dredging two very interesting crustaceans occurred, both belonging to the decapod family Astacidæ, and both participating in a singular deficiency, the total absence of eyes. One of these has been referred by Dr. v. Willemoes-Suhm to his genus Deidamia. It agrees with the species described in my former report in all its leading characters, although certain marked differences must lead to a slight modification of the characters of the genus as formerly defined. In *Deidamia leptodactyla* all the five pairs of ambulatory legs bear chelæ, while it is a character of the typical Astacidæ that chelæ are present on three pairs only. In the new species there are chelæ on four pairs of the ambulatory legs, the fifth pair ending in simple curved claws. The two species agree with one another, and with *Astacus*, in possessing a lamellar appendage at the base of the outer antennæ, and with this they have the flattened carapace of *Palinurus*. These characters have not been hitherto observed in combination, and their so occurring seems to be a more valuable generic character than the variable one of the form of the limbs. The character of this genus will now stand thus :—

Deidamia.—Cephalothorax flattened, with a compressed free lateral margin. A lamellar appendage at base of each of the outer antennæ. Swimmerets, consisting of three joints with two palpi. No trace of eyes or of eyestalks.

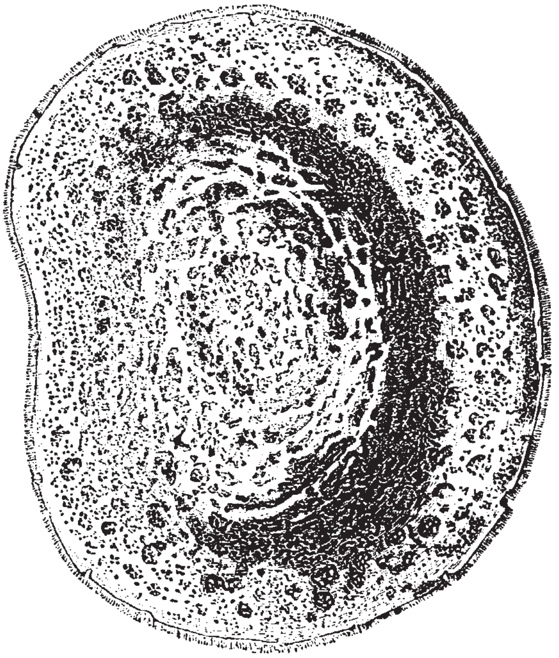

Fig. 3.—Hyalonema Toxeres, Wyville Thomson (Upper surface of sponge body).

D. leptodactyla v. W.-S.—All the ambulatory feet bearing chelæ.

D. crucifer v. W.-S.—Four pairs of the ambulatory feet bearing chelæ.

As in *D. leptodactyla*, not only are the eyes and eyestalks absent, but there is no indication of a space for their accommodation in the position in which eyes are normally developed.

Deidamia crucifer certainly differs widely in general appearance from the recent Astacidæ, at the end of which family we should, however, be inclined to place it for the present. It has a very close resemblance to some fossil forms, particularly the varying species of the genus *Eryon*. It has been already remarked that *Deidamia*, in its flattened cephalothorax, approaches the Palinuridæ; in all the living members of that family, however, the first pair of legs are monodactylous, while in *Deidamia* they are didactylous. The fossil genus *Eryon* forms an exception in this particular among Palinurids, with which it has hitherto been arranged, and has the first pair of limbs didactylous, as in *Deidamia*. It has not yet been ascertained whether *Eryon* has a lamellar appendage at the base of the outer antennæ. If this appendage be absent, there is probably scarcely sufficient ground for separating *Deidamia* generically from *Eryon*. It is very likely that when the recent deep-sea forms near the Astacidæ and Palinuridæ come to be carefully correlated with the cretaceous and Jurassic species, it may be necessary to establish an additional family.

The second crustacean, although having little of the facies of the typical *Astaci*, presents apparently no characters of sufficient value to warrant its separation from that genus.

Astacus zaleucus, v. W.-S. (Fig. 2), with its long compressed cephalothorax, flattened abdomen and unequal chelæ, has at first sight somewhat the appearance of a *Calianassa*.

The total length of the animal is 120 mm.; the cephalothorax, 50, and the abdomen, 60 mm. The carapace is hard, and firm, though only slightly calcified. It is greatly compressed laterally, rising into a high arch. It terminates in front in a slender spiny rostrum, 8 mm. in length. The rostrum is covered with a thick felting of hair, which extends backwards, forming two hairy triangles on the anterior part of the cephalothorax In front of the carapace, between its anterior and upper edge and the insertions of the antennæ, in the position of the eyes in such forms as *Astacus fluviatilis*, there are two round vacant spaces which look as if the eyestalks and eyes had been carefully extirpated and the space they occupied closed with a chitinous membrane. The lamellar appendage of the outer antennæ has teeth along its inner border. It extends to the middle of the second basal segment of the antenna, which is remarkably long. The flagella of the outer antennæ are 130 mm. in length. The inner antennæ originate in a line with the outer. The funiculus is shorter, and the flagella, which are equal in length, are much shorter than those of the outer antennæ.

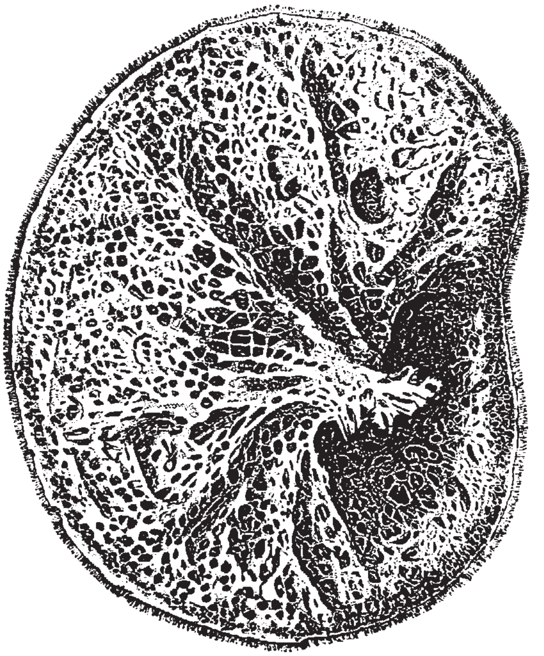

Fig. 4.—Hyalonema (Lower surface).

The parts of the mouth are normal. The three first pairs of ambulatory legs are terminated by chelæ, the fourth pair bear recurved claws, and the fifth abortive stump-like claws. The chelæ of the first pair of legs are strangely developed, particularly the right chelæ, which is double the length of the left, and with its formidable ranges of long spines along the inner border of each claw reproduces on a small scale the jaws of the Gangetic gavial. The last segment of the pereion is not covered by the carapace but is in moveable connection with it. The first segment of the abdomen is very small, and the segments gradually increase up to the fourth, which the fifth and sixth equal in size. The abdominal segments are flattened from above downwards. The telson is quadrate, and combines with the two pairs of caudal appendages, which are widely expanded laterally to form the caudal fin. The dorsal surfaces of the second, third, and fourth abdominal segments, and the margin of the tail, are thickly covered with woolly hair. The individual being a male, the first pair of swimmerets consist of long slender appendages, and the four succeeding pairs have one strong, round, basal joint, to which are attached two palpi fringed with hair. There is some resemblance between this form and *Calianassa*, but in this genus the lamellar appendage to the outer antenna is absent. There are four pairs of limbs with chelæ instead of three, and the carapace is soft.

To the genus *Astacus*, therefore, with which it has all characters in common except the great development of the right chela and the total absence of eyes—neither characters of generic value—the present species must be referred.

A. Zaleucus, n. sp. (Fig. 1).

Rostrum spiny, elongated. Lamellar appendage of the outer antennæ reaching to the middle of the second joint of the funiculus. Chelæ on three pairs of ambulatory feet, those on the first pair strongly but unequally developed. Cephalothorax very much compressed laterally, eyestalks and eyes entirely wanting.

On Sunday, March 16, we anchored in the Gregaria Channel, at the entrance of the harbour of Charlotte Amalia. We spent a few very pleasant days at St. Thomas, some of the civilians of our party enjoying greatly their first experience of life and scenery within the tropics. M. Gardé, the Danish Governor, received us with the most friendly hospitality. He is a naval man, and was greatly interested in our investigations, and his Aide-de-Camp, Baron Eggers, had collected and worked out the plants of the Island with care, and was otherwise well acquainted with its natural history.

The natural history of the island of St. Thomas is tolerably well known, and large collections of its fauna and flora have been sent home from time to time by very competent naturalists to the Museum at Copenhagen. On the present occasion our time was much too limited to attempt to make collections, so the naturalists contented themselves with a little shallow water dredging, and such a general survey of the island and shores as might familiarise them with the more characteristic forms of animal and vegetable life; for while the Atlantic Islands Madeira, and the Canaries, although gradually assuming a more tropical character, maintain the most intimate relations in natural products with the south of Europe, in Tropical America everything is changed, and it takes a little time to become familiar with new acquaintances whom one has hitherto known, if he has known them at all, only from descriptions or figures, or at best mummied or pickled, or otherwise in inadequate effigy. Ophiurideas are particularly plentiful at St. Thomas, and we made large collections of these, particularly of the many large and characteristic West Indian species of the genus *Ophioderma*.

On the 24th of March we left the harbour of Charlotte Amalia and proceeded with a light north-easterly breeze towards the Culebra passage. The next morning we sounded in 625 fathoms. The ooze was closer and more free from shells and coral than in the former haul, but otherwise much of the same character. This time the dredge came up about half full, and on sifting its contents many interesting additions were made to our collections. Here we met for the first time with the curious little crinoid, *Rhizocrinus lofotensis*, for which we had been on the outlook since the beginning of the cruise, and *Salenia varispina*, which we now recognise as a very widely distributed inhabitant of the deeper water.

This elegant little urchin (Fig. 2) is about 10 mm. in diameter of the test. It resembles in general appearance young specimens of *Cidaris hystrix*. The ambulacral zones are narrow, the interambulacral correspondingly wide, and both are furnished with double rows of flat, paddle-shaped, secondary spines beautifully striated in purple and white, ranged along the middle line, from which they shed outwards on either side. The primary tubercles are large, imperforate, and distinctly crenated. Some of the larger of the primary spines are 50 mm. in length, ·8 mm. in diameter, and cylindrical, gradually tapering towards the point. They are fluted and serrated along the ridges with sharp prickles. The spines in all the specimens we have dredged are very uniform; some are slightly curved, but they scarcely agree with the description given by Prof. A. Agassiz, from a young specimen, of being "of all shapes." The spines round the mouth are short, some of them slightly flattened and sharply denticulated.

The corals which were abundant in individuals were all deep-water forms. They have been examined by Mr. Moseley, who refers the majority to species which have been described by M. de Pourtalès * from the Straits of Florida.

Two examples of the sponge-body of a very handsome Hyalonema were sifted out of the coral mud. Unfortunately in both cases the sponge had been torn from the central coil, and the absence of the coil might have thrown some little doubt upon the form and mode of finish of the complete animal, so that it was extremely fortunate that a young specimen of the same species about 40 mm. in length was caught in the tangles quite perfect.

Hyalonema toxeres, new species, resembles closely the other known species *H. lusitanicum* and *H. sieboldi* in general appearance and in the arrangement of its parts. A more or less funnel-shaped sponge presents two surfaces covered with a network of different patterns formed by varying arrangements of large fine rayed spicules. The upper concave surface shows a number of oscular openings irregularly arranged, and the lower surface a more uniform network of pores, some of which seem to be inhalent and others exhalent.

The central axis of the sponge is closely warped into the upper part of a coil of long and strong glassy spicules which, as in the other species, serve to anchor the sponge in the soft mud. Both of the species dredged have the sponge more flattened and expanded than it is in *H. lusitanicum*. In one of them it is nearly flat (Fig. 3), forming a reniform cake-like expansion 80 mm. in length by 70 mm. in width, and about 8 mm. in thickness. The upper or oscular surface is covered by an exceedingly close network with groups of large openings at nearly equal intervals. It is slightly raised in the centre. The central elevation is followed by a slight depression, and the upper wall then passes out nearly horizontally to a sharp peripheral edge fringed with long delicate spicules, each consisting of a slender central shaft with a cross of four short transverse processes in the centre. The outer half of the central axis is delicately feathered. The lower surface of the sponge (Fig. 4) is protected by a singularly elegant net-work of sarcode with wide oval and round meshes radiating irregularly from a central point. The membrane is traversed by irregularly radiating ridges of firmer substance, which unite in the centre in a projecting boss at the point where, in this specimen, the "glass-rope" has unfortunately been torn out.

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* Illustrated Catalogue of the Museum of Comparative Zoology at Harvard College, No. 4—Deep-sea Corals. By L. F. de Pourtalès, Cambridge (Mass.), 1871.

WYVILLE THOMSON

(*To be continued.*)

THE ANCESTRY OF INSECTS

WITHIN a very few days after my last article on the "Origin and Metamorphoses of Insects" appeared in NATURE, I received from Mr. Packard a memoir,* under the above title, in which he developes his latest views on the same subject; and I am happy to find that his views do not differ so much from mine as I had supposed. He lays great stress, as is natural, on the larval forms. "If we compare," he says, "these early stages of mites and myriopods, and those of the true six-footed insects, as in the larval Meloë, Cicada, Thrips, and Dragon-fly, we shall see quite plainly that they all share a common form. What does this mean? To the systematist who concerns himself with the classification of the myriads of different insects now living, it is a relief to find that all can be reduced to the comparatively simple forms sketched above. It is to him a proof of the unity of organisation pervading the world of insects. He sees how Nature, seizing upon this archetypal form has, by simple modifications of parts here and there, by the addition of wings and other organs wanting in these simple creatures, rung numberless changes in this elemental form." And again (p. 151), "Going back to the larval period, and studying the insect in the egg, we find that nearly all the insects yet observed agree most strikingly in their mode of growth, so that, for instance, the earlier stages of the germ of a bee, fly, or beetle, bear a remarkable resemblance to each other, and suggest again, more forcibly than when we examine the larval condition, that a common design or pattern pervades all."

He distinguishes, as in his previous writings (p. 175), two principal types of larvæ:—

"There are two forms of insectean larvæ which are pretty constant. One we call leptiform, from its general resemblance to the larvæ of the mites (Leptus). The larvæ of all the Neuroptera, except those of the Phryganeidæ and Panorpidæ (which are cylindrical, and resemble caterpillars), are more or less leptiform, *i.e.*, have a flattened or oval body, with long thoracic legs. Such are the larvæ of the Orthoptera and Hemiptera, and the Coleoptera (except the Curculionidæ; possibly the Cerambycidæ and Buprestidæ, which approach the maggot-like form of the larvæ of weevils). On the other hand, taking the caterpillar or bee larvæ, with their cylindrical fleshy bodies, in most respects typical of larval forms of the Hymenoptera, Lepidoptera, and Diptera, as the type of the eruciform larva," &c.

At first sight it would appear that Mr. Packard's conclusions differ widely from those which I have advocated. He rejects, indeed, the suggestion made by Haeckel that the "common stem form of all Tracheata" may be found in "Zoeaform Crustacea." It is evident, he says (p. 159), that "the Leptus fundamentally differs from the Nauplius and begins life on a higher plane. We reject, therefore, the crustacean origin of the insects." And elsewhere "we find through the researches of Messrs. Hartt and Scudder that there were highly-developed insects, such as may-flies, grasshoppers, &c., in the Devonian rocks of New Brunswick, leading us to expect the discovery of low insects even in the Upper Silurian rocks. At any rate this discovery pushes back the origin of insects beyond a time when there were true Zoëæ, as the shrimps and other allies are not actually known to exist so far back as the Silurian, not having as yet been found below the coal-measures."

But then he observes that the "larvæ of the earliest insects were probably leptiform, and the eruciform condition is consequently an acquired one, as suggested by Fritz Müller." Again, "for reasons which we will not pause here to discuss, we have always regarded the eruciform type of larva as the highest. That it is the result of degradation from the Leptus or Campodea form, we should be unwilling to admit." And once more, "The Caterpillar is a later production than the young, wingless Cockroach."

Mr. Packard had already expressed these opinions elsewhere, and as I have on the contrary suggested that the grublike, or Lindia-forms were the first to come into existence, then the Tardigrade-form, and lastly, the Campodea-form, I had supposed that our views were in direct opposition to one another: but I am glad to find from other passages that after all there is not so much difference as these passages would seem to indicate. I cannot, indeed, agree with him in his classification of Insect larvæ; he ranks the Caterpillars with the grubs and maggots of Bees and Flies, as a class for which he proposes the term "eruciform" in opposition to the "leptiform" larvæ of Orthoptera, Hemiptera, and most Coleoptera. It seems to me, on the contrary, that the two great groups are the Hexapod or Campodea-form, and the apod, grublike type, which I have proposed to call the Lindia-form. At the first glance, no doubt, the heavy sluggish Caterpillar seems to have more in common with the grub of a Bee than with the active larvæ of Coleoptera. The difference, however, is one of habit, not of type.

As regards the ancestral forms of Insects, Mr. Packard considers that "while the Poduras (p. 154) may be said to form a specialised type, the Bristle-tails (*Lepisma*, *Machilis*, *Nicolitea*, and *Campodea*) are, as we have seen, much more highly organised, and form a generalised or comprehensive type. They resemble, in their general form, the larvæ of Ephemerids, and perhaps more closely the immature Perla, and also the wingless Cockroaches. Now such forms as these Thysanura, together with the mites and singular Pauropus, we cannot avoid suspecting to have been among the earliest to appear upon the earth; and putting together the facts, first, of their low organisation, secondly, of their comprehensive structure, resembling the larvæ of other insects, and thirdly, of their probable great antiquity, we naturally look to them as being related in form to what we may conceive to have been the ancestor of the class of insects. Not that the animals mentioned above were the actual ancestors, but that certain insects bearing a greater resemblance to them than any others with which we are acquainted, and belonging possibly to families and orders now extinct were the prototypes and progenitors of the insects now known."

As regards the probable origin of this Leptus form, Mr. Packard's views are expressed in the following passage (p. 169):—"While the Crustacea may have resulted from a series of prototypes leading up from the Rotifers, it is barely possible that one of these creatures may have given rise to a form resulting in two series of beings, one leading to the Leptus form, the other to the Nauplius. For the true Annelides (Chætopods) are too circumscribed and homogeneous a group to allow us to look to them for the ancestral forms of insects. But that the insects may have descended from some low worms is not improbable, when we reflect that the Syllis and allied genera of Annelides bear appendages consisting of numerous joints; indeed, the strange *Dujardinia rotifera*, figured by Quatrefages, in its general form is remarkably like the larva of Chloëon."

Moreover, though Mr. Packard says that "the caterpillar is a later production than the young wingless, cockroach," he elsewhere (p. 182) says, "it is evident that in the

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* Being a chapter from "Our Common Insects," by A. S. Packard, jun. (Printed in advance.)